AmeriCorps New Jersey Watershed Ambassadors Program

Habitat Assessment Quality Assurance Project Plan

New Jersey Department of Environmental Protection
Water Monitoring and Standards

February 26, 2016

QUALITY ASSURANCE SAMPLING PLAN
Habitat Assessment Quality Assurance Project Plan

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Signature Date

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2015-2016

Table of Contents

1.0	Project Name	page 4
2.0	QAPP Document Location	page 4
3.0	Requesting Agency	page 4
4.0	Project Fiscal Information	page 4
5.0	Project Manager	page 4
6.0	Project Duration	page 4
7.0	Special Training Needs/Certification	page 4
8.0	Project Background	page 4
9.0	Project Description	page 5
10.0	Sampling Network and Design	page 5
11.0	Sampling Procedures	page 6
12.0	Field Parameters	page 7
13.0	Flow Monitoring	page 7
14.0	Field Quality Assurance and Quality Control	page 7
15.0	Continuous Data Quality	page 8
16.0	Equipment/Software Used To Handle Data	page 9
17.0	Target Data Storage (Internal to Division)	page 9
18.0	Target Data Storage (External to Division)	page 10
19.0	Data Validation	page 10
20.0	Supplemental Data	page 11
21.0	Data Usage	page 11
22.0	Assessment, Oversight, and Response	page 11
23.0	Data Reporting	page 11
APPENDIX I		page 13
APPENDIX II		page 43

1.0 Project Name: Habitat Assessment Quality Assurance Project Plan

2.0 QAPP Document Location: V:\lum\polplan\Envplan\Division of Watershed Management\OWEEM\AmeriCorps\NJWAP Program Files\Monitoring\QAPP

3.0 Requesting Agency: NJDEP, Water Monitoring and Standards

4.0 Project Fiscal Information: Job Number: 2AMERICX, Activity Codes: 2420; 2610; 3810

5.0 Project Manager: Jennifer Noblejas, Environmental Specialist 3, BEARS

6.0 Project Duration: September 1 thru July 31st each year

7.0 Special Training Needs/Certification

The Ambassadors will be required to attend a multiday training session on habitat assessment protocols. The Ambassadors will be evaluated on their ability to correctly perform an assessment at the conclusion of the training program in September. Ambassadors will have approximately ten months to complete their required assessments and Program staff will track and follow up with anyone not submitting completed datasheets within the designated time period. Furthermore, the Project Manager and as needed, Department staff, will meet with Ambassadors during monthly staff meetings to discuss their work and answer any questions the Ambassadors may have about field work.

8.0 Project Background

The AmeriCorps New Jersey Watershed Ambassadors Program (Program) is an environmental community service program administered by the New Jersey Department of Environmental Protection (Department) to raise public awareness about water and watershed issues and to promote watershed stewardship through direct community involvement. AmeriCorps is a part of the Corporation for National and Community Service, which engages more than 2 million Americans of all ages and backgrounds in community service each year. The Department began hosting the Program in September of 2000, under an AmeriCorps State contract with the Corporation for National and Community Service. Through this Program, AmeriCorps members are recruited on an annual basis and trained as "Watershed Ambassadors" (Ambassadors) to work with host agencies in each of New Jersey's twenty Watershed Management Areas (WMAs) to serve their watershed community. Part of that service includes coordinating and training the local community in assessments of local rivers and streams using both habitat and biological assessment protocols. The Program runs from September through July.

There are 18,126 river miles in the State of New Jersey. In the 2014 statewide water quality assessment, approximately 62% of the State's waters were assessed for biological health using a true biological indicator, leaving about 38% as unassessed based on biology. Because of the number of river miles we have within the State, the Department relies on partners, volunteers and the Ambassadors to help fill our data gap needs for assessment. Each Ambassador performs a number of habitat assessments throughout their WMA.

9.0 Project Description

Every year, the Ambassadors are required to complete habitat assessments within their WMA between October and July. Assessments are conducted at locations based on local and Department priorities in each WMA. Ambassadors conduct assessments in a 100 meter (approximately 300 feet) stream reach. Assessments also provide information as to where unmapped outfall pipes and drainage ditches exist. High gradient and low gradient streams are assessed differently based on different characteristics found in each type of stream. At the conclusion of their assessment, all Ambassadors must follow the proper protocols for decontaminating their equipment. See the Habitat Assessment Manual (Appendix I) for more details on assessment protocols.

Ambassadors will record data from their habitat assessments on the Department Habitat Assessment Sheet and submit the data onto either the High Gradient or Low Gradient Habitat Geoform on ArcGIS. Once all data is submitted for the year, the data will be quality assured as stated in the data validation section and uploaded into an internally maintained data management system.

FIELD MONITORING

10.0 Sampling Network and Design

Sampling will be performed within each of the 20 watershed management areas in New Jersey. Each ambassador is given a set of priority assignments based on the needs of the Bureau of Environmental Analysis, Restoration and Standards and previous ambassadors' recommendations. The remaining sites will be selected by each ambassador based on the needs of the community, host agency or their own inquiry.

Visual assessment reaches will average about 100 meters. The actual stream reach length will be determined by access limitations such as property lines and safety considerations. If an Ambassador is unable to perform the required assessments, s/he must contact the Program Manager so other assignments can be given.

For each habitat assessment performed, a Department Habitat Assessment Sheet will be completed. Assessment locations will be identified using NJ GeoWeb/ArcGIS, Google maps, latitude/longitude smartphone application or another tool available to them. The Ambassador is responsible for verifying coordinates. Ambassadors must work in pairs for safety reasons.

Inclement weather and potential high flows or low flows in stream could be obstacles to performing assessments within the suggested monthly assessment guidelines, but should not pose an issue within the overall timeframe. In the case of high flows, icy conditions or other situations where the ambassador cannot safely enter the stream, there is the option of conducting a non-wadable visual assessment. In these cases, the Ambassador will estimate stream width and will not take stream depth, water temperature and stream velocity measurements. It is envisioned that some streams will be less accessible due to topographic, safety or private property issues. Ambassadors are encouraged to locate public access points. For safety and data quality purposes, Ambassadors must check the local weather prior to heading into the field to perform an assessment.

Sampling Design Logistics:

Type of Assessment/Parameter	Number of Assessments	Assessment Frequency	Assessment Period	Assessment Locations
Habitat	A minimum of 24 stream habitat	Ambassadors are given the option to submit 2 repeated assessments at the same site.	October – July	TBD in each WMA according to Department and local priorities

11.0 Sampling Procedures

11.1 General Procedures

The Ambassadors perform habitat assessments according to Department standard procedures. The habitat assessment that is used is the Department's Rapid Bioassessment Protocol with additional visual and physical information added to it. The protocol was developed using components of the following standardized and accepted methodologies:

- USDA Stream Visual Assessment[1]
- Center for Watershed Protection's Unified Stream Assessment: A User's Manual[2]
- NJ DEP AMNET Physical/Habitat Protocol[3]
- US EPA Rapid Bioassessment Protocol
- US EPA National Lakes Survey

The goals of integrating these various protocols is to reduce the amount of subjectivity and create a more user-friendly stream assessment that provides useful information that anyone is able to collect with the proper training. See Habitat Assessment Manual (see Appendix I)

11.2 Chain of Custody Form

Not Applicable as no lab work will be performed.

11.3 Cleaning Sampling Equipment

DIDYMO (Rock Snot) DECONTAMINATION

Treat all streams like they have Didymo, not just ones that have been confirmed. Didymo is not visible to the naked eye at first and by the time you see it, it is too late. When collecting macroinvertebrates from the stream, you must return them back to the same stream and the same location. No mixing samples. If you want to do more than one assessment in a day you should only work on one stream per day. Start upstream and work downstream when changing locations (following how the river flows), to avoid contaminating any upstream locations that have not been exposed to Didymo. You should

[1] USDA NWCC Technical Note 99-1. Stream Visual Assessment Protocol, December, 1998.
[2] Kitchell, Anne, and Tom Schueler, Center for Watershed Protection. Unified Stream Assessment: A User's Manual Version 1.0, March, 2004.
[3] NJ DEP, Bureau of Freshwater and Biological Monitoring, Standard Operating Procedures. Ambient Biological Monitoring Using Benthic Macroinvertebrates. Field, Lab, and Assessment Methods. December 2007.

clean your equipment after each day if working in the same stream or in between sampling events on different streams.

You must decontaminate all small equipment (e.g., buckets, nets, water sampling equipment) AND Personal Protective Equipment (e.g., rain gear, gloves, boots, waders and PFDs)

1. Remove all organic material from gear
2. Fill bucket with Alconox and stream water and place all equipment in the tub.
3. Scrub small and personal protective equipment.
4. Rinse or let dry completely

11.4 Equipment Calibration

Each of the Watershed Ambassadors is assigned equipment, including thermometers, meter sticks and tape measures, which is thoroughly inspected by the AmeriCorps Program Manager/Staff before it is distributed at the beginning of the year. Each Watershed Ambassador is responsible for maintaining their assigned equipment.

Coordinates recorded will be checked using additional mapping tools like Google Maps, NJ GeoWeb or other available mapping tools.

Thermometers will be calibrated using the Temperature Calibration SOP at the beginning of the program. This calibration will occur every year at the beginning of field season. Thermometers that are off by 0.5 degrees or more will be discarded via lab procedures and replaced by the AmeriCorps Program Manager. Calibration logs will be filled out for each thermometer and saved by WMS staff.

12.0 Field Parameters

The parameters which will be measured on site include site location's latitude/longitude, air and water temperature, stream width, depth and velocity, water conditions, stream characteristics, land use and habitat scored monitoring. See Appendix I for Habitat Assessment Manual.

13.0 Flow monitoring

Stream velocity will be measured. With a stopwatch, measure the time it takes your rubber duck to float the 10 feet section. Repeat 5 times using the same floating tool, in the same 10-foot section and record each time on your data sheet. Then average the 5 times to determine the average time. Divide the distance (D = 10 feet) by the average time (T) to determine velocity in feet per second (V = D/T). Convert to meters/second. Record this on your data sheet.

14.0 Field Quality Assurance and Quality Control

MEASUREMENT QUALITY OBJECTIVES

Parameter	Measurement Range	Accuracy	Precision
Geographic Coordinates via Smartphone and/or Google maps	± 90° N and ± 90° E depending on satellite availability	Unbiased	±100 feet

Thermometer	0 °C - 40 °C	Must be calibrated within +/- 0.5°C	0.1 °C
Reference Site Visits to verify field protocols	See Reference Site Locations table	Ambassador must not deviate significantly from appropriate techniques	

REFERENCE SITE LOCATIONS

Region	WMA	Lat	Long
Upper Delaware	11	40.619589	-75.077796
Northeast	6	40.768281	-74.532419
Raritan	8	40.737141	-74.622499
Lower Delaware	19	39.929073	-74.531229
Atlantic Coastal	13	40.095908	-74.320107

Habitat Assessment Technique Quality Control (QC) Check

Ambassadors will perform a habitat assessment at their regional reference site visits in September/October to ensure they are following the proper protocol demonstrated at the trainings. This evaluation will occur after macroinvertebrate and habitat training and prior to the start of the biological/habitat assessment period and will be performed by Department/Program staff. If the Ambassador fails to demonstrate proficiency in the appropriate techniques, the Ambassador's data will not be considered for the Department's assessment purposes. The regional reference site visits surveys as the auditing process for the program.

Data Representativeness

Each AmeriCorps member will be monitoring one of the 20 watersheds throughout the state. Within the state we have diverse land uses and three defined ecoregions: Coastal Plains, Pinelands and High Gradient. Land uses include rural, suburban and urban classifications. Each watershed differs depending on these ecoregions and land use classifications. The training designed for the Ambassadors has been tailored to cut down on regional biases as much as possible so sites across watershed boundaries are comparable to each other. Ambassadors are also individually evaluated to determine their comprehension of the visual assessment protocols.

Data Comparability

Aspects of the assessment protocol, such as all qualitative habitat methodologies, will involve a greater degree of subjectivity and a coarser level of comparability. This variability is unavoidable in a rapid visual assessment protocol. A relatively high degree of comparability within the study will be attained, through an intensive two day training session involving

conceptual overview and practical exercises in the field, as well as a final assessment of participants to standardize each Ambassador's perception of watershed features. Ambassadors are instructed, when possible, to add descriptive information to their assessment for clarification. Water Monitoring and Standards staff will collect habitat assessment sheets from each ambassador at Parvin and at the reference site visits to ensure that the sheets are filled out correctly. Finally, NJDEP staff will review all AmeriCorps data sheets and evaluate them for completeness and accuracy at the end of their term of service through a visual inspection of their field sheets. Both gaps in the collected data as well as apparent anomalies will be addressed, further heightening the internal comparability of the program's habitat assessment results.

Naming Sites

Ambassadors are asked to check whether a site has already been named by a previous Ambassador, USGS, or are currently one of the Department's Bureau of Freshwater and Biological Monitoring's sites. Sites will be named in accordance with procedures documented in the Habitat Assessment Manual. Site naming will be consistent for all monitoring activities.

Data Completeness

Data will be checked for completeness first by the AmeriCorps member prior to leaving the field assessment location. All fields will be checked to ensure they are filled out and the data sheet is complete. An incomplete web sheet will not count as an assessment towards their assessment goals for the program. Completeness will then be checked again when Ambassadors enter data onto the Habitat Assessment Geoform. Data will not upload properly via the Geoform web system if fields are not filled in. NJDEP/Program staff will also review and check assessments to ensure they are complete and accurate.

15.0 Continuous Data Quality

Not applicable as no continuous data will be collected.

LABORATORY ANALYSIS

Not applicable as no lab work will be performed.

DATA MANAGEMENT / ASSESSMENT

Water quality data sampled under this project will be used in the water quality assessment of New Jersey waters. The AmeriCorps data will be used in the assessment of Aquatic Life General Designated Use and to fill data gaps for the Regional Comprehensive Assessments.

16.0 Equipment/Software Used To Handle Data

16.1 Purchase of equipment

Ambassadors currently are not required to utilize mobile devices to record data collected and observed in the field. The preferred data flow is to record results and measurements onto a hard copy datasheet. They then bring that datasheet back to the office to enter results into the OIRM supported Biological GeoForm application.

In the future, the Ambassador Program may pilot the use of mobile devices in the field for entering data into the Biological GeoForm. When and if this is decided to be the course of action, several devices will be purchased as a test case to evaluate the scalability of using this for the entire AmeriCorps Program. Along with the mobile devices, the use of MiFi Wireless Routers will also be reviewed for flexibility and reliability in the field.

In order to successfully submit data to WQDE, a specific file structure prior to submission must be obtained. To do this, a copy of FMS's Total Access Statistics (TAS) software will be required. The Data Manager will work with the Project Manager to ensure a smooth transition in usage of this software. In the event that the Project Manager cannot obtain this software, the Data Manager will utilize the TAS software on their machine and send the Project Manager the customized file outputs that this software creates.

16.2 Collecting Data

The data will be recorded in the field using the habitat assessment sheet. Once the field data is collected the Ambassadors must enter and submit their data into the Habitat Geoform on ArcGIS. Geoform provides flexibility for the Ambassadors to enter and submit their data in the field as long as a wireless connection is available, or they can choose to enter the data at their office via a URL link.

17.0 Target Data Storage (Internal to Division)

17.1 Data owner

The Bureau of Environmental Analysis, Restoration and Standards will own the field data and manage the data internally.

17.2 Data storage

Data confirmed to be accurate in GeoForm will be uploaded into an internal MS Access storage system known as AmeriCorps. Once data exists in the AmeriCorps MS Access database, the Project Manager will make one final review of the data to ensure it's accurate. Throughout the entire process, the Project Manager may ask or request the Data Manager of this project for assistance in formatting, fixing, or identifying any issues discovered with the MS Access system.

Data storage for site specific location information will be handled between the Project and Data Manager. Due to the large volume of sample sites, site specific information will not be included in this QAPP, but an electronic file generated by the Project Manager will be given to the Data Manger to electronically transfer the information into the MS Access System.

18.0 Target Data Storage (External to Division)

Once data is confirmed to be accurate in the AmeriCorps database within BEARS, the data will be automatically formatted to be compatible with the Department's Water Quality Data Exchange (WQDE) system. Automated file format will occur within MS Access. The Data Manager for this project will ensure that the automated formatting of information to be compatible with WQDE happens accurately. Further, if any assistance is needed to submit these files to WQDE, the Data Manager will work with BEARS to troubleshoot or tweak files to ensure successful file submissions.

Once the data is submitted to WQDE, by default, it will then be sent to the Environemental Protection Agency's (EPA) Storage and Retrieval System (STORET). Then from this point, the data will be sent to the National Water Monitoring Council Water Quality Portal. The data then becomes Public once data resides in STORET and the WQ Portal.

Table X: URL links for data access

Data Source	Location	Internal	External
National Water Monitoring Council Water Quality Portal	http://www.waterqualitydata.us/		X
EPA STOrage and RETrieval (STORET)	**http://www.epa.gov/storet/dbtop.html**		X
Water Quality Data Exchange (WQDE)		X	

18.3 Data Input into Data Storage Locations

Data will be updated into the MS Access System and WQDE once a year or on an as needed basis if there are issues with the original submission.

19.0 Data Validation

Review of the datasheets will be conducted by the Project Manager. If incomplete or inaccurate data appears to be submitted, the Project Manager will consult the Watershed Ambassador to request that the data be reviewed and corrected. Once the Project Manager is satisfied with the quality of data residing in GeoForm, they will work with the Data Manager of this project to move the records from GeoForm, to an internal MS Access database customized specifically for AmeriCorps. The Project Manager will check the data again once it is in the AmeriCorps database. The Project Manager will review and verify such things as the Site ID and name, site coordinates, data results are within acceptable ranges and flagging Ambassadors that do not pass the QA/QC tests.

Ambassadors will also submit hard copies of their assessments at the end of their term of service. Data that are incomplete or anomalous will be evaluated for their utility. Anomalous data will be scrutinized carefully to determine whether any portion of the data is valid, and whether questionable data can be rectified with follow-up field assessments by Program staff. Anomalous data which cannot be corrected or completed will be entered but will be flagged as preliminary and unverified data. Similarly, incomplete data will be flagged in the data sets as partial data records. Any data that does not match up with the configuration file will be rejected from the system.

19.1 Data Management QA Procedures

The Project Manager will review the submittals from the Geoform at the end of the year and will upload the data into the AmeriCorps database. The submittals that pass the QA check will be marked off and uploaded into the data management system. Those submittals that do not pass the QA check will not marked off so it is not uploaded into the data management system.

20.0 Supplemental Data

In addition to performing a habitat assessment, the Ambassadors will record any pipes or ditches within their stream reach on the Pipe and Ditches Log. This will provide additional information to the outfall inventory for the stormwater program.

21.0 Data Reporting

Not Applicable

22.0 Assessment, Oversight, and Response

Ambassadors' performance is reviewed by the Project Manager. Follow up with Ambassadors regarding their performance will occur on an as-needed basis. Data will be evaluated and if errors in the submitted data are found, the Ambassador will be contacted for corrections. However, if the Ambassador has already exited the program, Department staff will correct data or flag it so it will not be used for assessment purposes. In addition, if members are not able to pass proficiency sampling and identification, Ambassadors' data will not be considered for assessment purposes. Ambassadors will always be given access to technical assistance from Department staff as needed.

In the occasion of a major weather event, the Ambassadors will be notified to cease all monitoring activities until cleared by the Department to resume sampling. If at any time equipment is lost, broken, or in need of replacement or repair, members should notify the AmeriCorps Program Manager. If regulated pollution incidents are observed by volunteers during their surveys, they will be instructed to report the pollution incident to the NJDEP hotline (1-800-WARN DEP) and any other appropriate agencies and alert Program staff of the problem for follow-up.

23.0 Data Usage

Water quality data sampled under this project will be used in the water quality assessment of New Jersey waters. All sampling procedures must be in conformance with NJDEP Volunteer Monitoring Program's Habitat Assessment Manual.

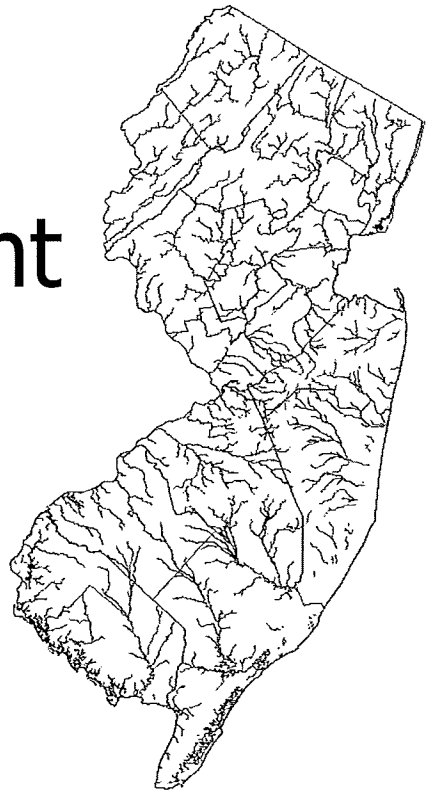
24.0 Corrective Action

If a method or procedure requires change this information must be brought to the attention of the signatories of this QAPP through writing and needs approval prior to being used.

NJDEP Volunteer Monitoring Program

New Jersey Department of Environmental Protection

Habitat Assessment Manual



A guide to filling out the NJDEP Volunteer Habitat Monitoring Assessment

Visit us on the web for more info @
http://www.state.nj.us/dep/wms/bwqsa/vm/

2015-2016

Table of Contents

Background on the NJDEP Volunteer Monitoring Program.....4

Before Heading into the Field.....4

Suggested Equipment List

Filling out your Monitoring Packet.....5

Page 1: The General Sheet

Page 2: The Land Use Assessment Sheet

Page 2: Site Sketch

Page 3: Scored Monitoring

Page 5: The Pipe/Drainage Ditch Inventory Sheet

General Monitoring Sheet.....5-10

Site Name and Site ID

Watershed Management Area & County

Segment Identification

Survey Team, Activity Time & Date

Weather Conditions &Temperature

Water Conditions: Odor, Turbidity, Surface Coating, & Flow

Stream Measurements: Width, Depth, & Velocity

Stream Characteristics: Tree Canopy Cover, Woody Debris, Predominant Aquatic Vegetation, Algae Growth and Type, Litter Concentration and Structures

Land Use Form..... 11

Streamside Land Use

Other Observations

Site Sketch.....12

Scored Monitoring Sheet..... 13-17

Epifaunal Substrate Available Cover

Pool Substrate Characterization – Low Gradient ONLY

Embeddedness – High Gradient ONLY

Depth/Velocity Combinations – High Gradient ONLY

Pool Variability– Low Gradient ONLY

Sediment Deposition

Channel Flow Status

Channel Alteration

Scored Monitoring Sheet (continued).....17-19

Channel Sinuosity – Low Gradient ONLY

Frequency of Riffles – High Gradient ONLY

Bank Stability

Bank Vegetative Protection

Riparian Vegetation

Habitat Score

Pipe Inventory Sheet..... 20

Outfall Pipe Reference #

Pipe Location

Pipe Type, Diameter, and Material

Pipe Flow/Appearance

Appendices.....21-33

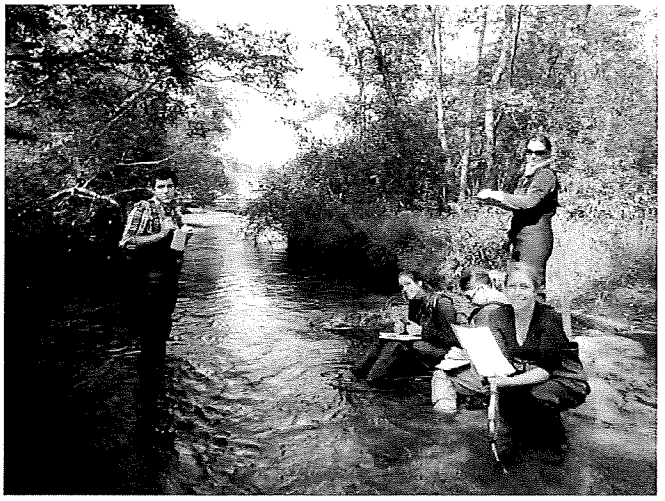
Glossary

Didymo Decontamination Procedure

High Gradient and Low Gradient Habitat Assessment Sheets

Background on the DEP Volunteer Monitoring Program

The NJDEP and other stakeholders across New Jersey have been utilizing the help of volunteers to collect valuable data on surface water quality and watershed health. Volunteer water monitors are of vital importance to the continuation of monitoring efforts throughout the state.



NJDEP's Volunteer Monitoring Program and the Watershed Watch Network are coordinated within Water Monitoring & Standards' Bureau of Environmental Assessment, Restoration and Standards. The Watershed Watch Network acts as an umbrella for the volunteer monitoring programs in New Jersey.

Before Heading into the Field

NJDEP is not liable for any event that occurs during monitoring.

1. Determine if it's the right time of year for monitoring, especially if you plan to enter the stream.

-Best times are spring, summer, and fall
-Worst times are drought, extreme summer days and during flooding and after storm event
-Do not sample during cold winter months

2. Confirm the location and time with your sampling partner. **Always monitor with another person.**

3. Check to make sure you have all of your equipment before heading into the field.

Suggested Equipment List

- ✓ Data Sheets
- ✓ Clip Board and Pen/Pencil
- ✓ Measuring Tape
- ✓ Meter Stick
- ✓ Floatable Rubber Ducky
- ✓ Proper Attire
  - Waders, Boots, Long Sleeves, Safety vest
- ✓ Water Bottle
- ✓ GPS/Smartphone
- ✓ Whistle
- ✓ Sunscreen, Bug Repellent
- ✓ First Aid Kit

IMPORTANT:
A WADABLE stream is one that you can safely enter and stand. The water level should be no more than thigh high.

A NON-WADABLE stream is a stream in which the current in moving too fast or the depth of the stream is unsafe for you to walk in. You can assess the stream from a bridge, road crossing or streambank.

In high-flow or icy conditions, or if the stream is just not accessible, you can perform a NON-WADABLE assessment. This means that you will estimate the width of the stream and you will not take velocity, depth or water temperature measurement.

DIDYMO (Rock Snot) DECONTAMINATION

Treat all streams like they have Didymo, not just ones that have been confirmed.

Didymo is not visible to the naked eye at first and by the time you see it, it is too late.

When collecting macroinvertebrates from the stream, return them back to the same stream and the same location. No mixing samples.

If you want to do more than one assessment in a day you should only work on one stream per day. Start upstream and work downstream when changing locations (following how the river flows), to avoid contaminating any upstream locations that have not been exposed to Didymo.

You should be clean your equipment after each day in same stream or in between sampling events on different streams.

You must decontaminate all small equipment (e.g., buckets, nets, water sampling equipment) AND Personal Protective Equipment (e.g., rain gear, gloves, boots, waders and PFDs)

1. Remove all organic material from gear
2. Fill bucket with Alconox and stream water and place all equipment in the tub.
3. Scrub small and personal protective equipment.
4. Rinse or let dry completely

Filling out your Monitoring Packet

Note: There are two sheets that may be used, **HIGH GRADIENT** or **LOW GRADIENT**

Each time you go out into the field to begin a habitat assessment, make sure to have all 5 pages of your monitoring packet; General, Site Sketch, Scored Monitoring, Land Use, and Pipe & Drainage.
Fill out all sections in the field.

Page 1: The General Sheet
The *General Sheet* is used to determine a wide range of information such as stream characteristics, location of the assessment access point, current weather conditions and stream name. This section should be completed after the entire stream-reach has been walked. To properly identify the exact coordinates of each site, we recommend using a Smartphone GPS app as described in the appendix. Also, free online tools like NJ GeoWeb or Google maps can be used, as well as using ArcGIS.

Page 2: Land Use
The *Land Use* page is meant to provide general information about the surrounding watershed. Make sure to consider any land use within view of your monitoring location that may influence stream habitat. Land

use data collected on this sheet is extremely useful to water quality data users within the NJDEP because it allows streamside land use to be assessed more frequently.

Page 2: Site Sketch
Each *Site Sketch* ensures that we understand physical characteristics of the stream and the land use surrounding the immediate monitoring location. While sketching the site, keep in mind the importance of adding reference points such as road names or GPS points to the map. Add anything note-worthy in and around the stream such as flow direction, riffles, pools, runs, debris, outfalls, riprap, etc.

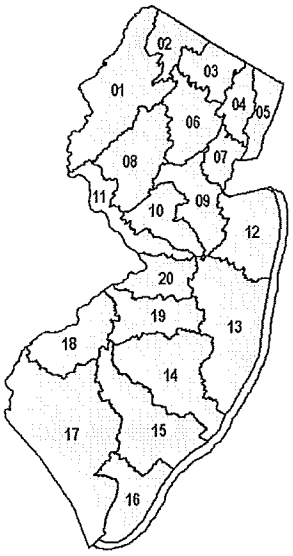
Page 3: Scored Monitoring
The *Scored Monitoring* sheet collects detailed information about the physical parameters of each stream. Depending on the location of the stream, either the high gradient or low gradient form will be used. This section scores parameters individually from 1 to 10 or 1 to 20 and identifies a rating of optimal, suboptimal, marginal, and poor. After completing this section, determine the total score.

Page 5: The Pipe/Drainage Ditch Inventory Sheet
The *Pipe Ditch Inventory* is used if a drainage ditch or pipe is encountered while conducting an assessment. The data collected helps us to determine point and non-point sources of pollution that may be entering the stream. Each pipe should be geospatially located for potential follow-up at that location and identified on site sketch.

General Sheet

Site Name and Site ID

Site Name: This is a unique name that you will give each site. The name you select should be descriptive and include the local name for the water body. Example, if you are going to a site on the Passaic River, your site name can be "Passaic River at intersection of Rt. 3 and Board St."



Site ID: The Site ID starts with WA (Watershed Ambassador) followed by the closest AMNET site or USGS station. Example: WA0689. Multiple assessments at the same AMNET location can be identified using a, b, c as you move upstream. Example: WA0689a. If there are no AMNET or USGS sites at the location and no other sites have been created by previous Ambassadors (you will need to check on NJ GeoWeb or ArcGIS before you go out in the field), you will use the first 4 letters of the stream. Example: Passaic River will be WAPASS. If the stream is named "Passaic Tributary", you can use WAPASSTRIB. If you are conducting multiple assessments you can use 1, 2, 3 as you move upstream. Example: WAPASS1.

Watershed Management Area & County

WMA: This refers to one of the 20 **W**atershed **M**anagement **A**reas identified by the Department. See the attached map or NJ GeoWeb/ArcGIS for this information.

County: The name of the county you are doing the assessment in.

Segment Identification

The stream segment you are assessing should be 100 meters (328 feet).
Latitude/Longitude: Take a GPS point at the starting point of your assessment

Estimate of Segment Length: Estimate the length of the reach (aim for 100m)

Record the Latitude and Longitude on your data sheet. You can also check accuracy of GPS points by identifying the latitude and longitude on a USGS topographic map, NJ GeoWeb, ArcGIS or Google maps.

Survey Team, Activity Time & Date

Survey Team: Record the names of the people involved in the assessment.
Activity Time & Date: Record the date and time when the assessment was performed.

Current Weather, Days Since Last Rain, & Temperature

Current Weather: Check the one that best describes the weather conditions on the day of the assessment

Days Since Last Rain:
Weather can affect assessment interpretation, so it is important to record recent rainfall or drought conditions. Record the number of days since the last rainfall in the space provided. You can also check the volunteer weather monitoring site at http://www.cocorahs.org/ or visit the National Weather Service at http://water.weather.gov

Current Temperature: Enter the air and water temperature in °C. If you need to convert Fahrenheit to Celsius use the Converter at http://www.wbuf.noaa.gov/tempfc.htm

Water Conditions: Odor, Turbidity, Surface Coating & Flow

Odor

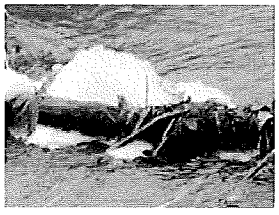
The odor of the stream will be dependent upon many things such as the time of year. Circle the option that best describes the general water odor along the stream.

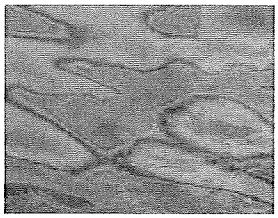
Turbidity

Turbidity is the measure of total suspended solids in the water causing a decrease in clarity. Keep in mind that the natural color of the stream will be dependent upon what region you are assessing. For example, tea colored water in the pinelands does not mean high turbidity. Circle the option that best describes the turbidity of your stretch of stream.

Surface Coating

Determine if there is a coating on the surface of the water. Circle the option that best describes the surface coating you see in your stretch of stream.





Hints-
Foam: Foam can also be naturally occurring. One way to help determine if it is natural foam or petroleum-based foam (usually soap or detergent) is by looking closely at the bubbles within the foam. If the bubbles have a noticeable iridescent look to them, it is likely to be petroleum based.

Oil: An oily sheen can be naturally occurring or petroleum-based. To determine the type of sheen, move the surface water around with a stick or throw a rock into it. If the oily coating is natural, it will break up and look like puzzle pieces and will not float back together. If the oily coating is petroleum-based, it will break up but then quickly move back together.

Pollen Coating: A coating of pollen on the surface of the water.

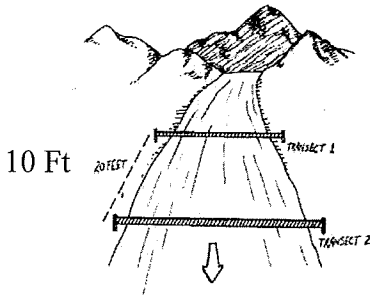
Stream Flow

Consider the whole 100 meter stretch to determine how the stream appears to be flowing.

Circle the option that best identifies the reach.

1. Slow means that when looking at the stream the water does not appear to be moving or is barely moving.
2. Moderate means that when looking at the stream, the water appears to be moving but the surface still appears flat.
3. Swift means that the water is moving fast and the surface of the water is not flat.
4. Combination means that the flow in the reach varies because the reach is made up of pools and riffles and/or constrictions that are causing small pooling of water.

Transect Measurements (Width, Depth & Velocity)



Using your flags, mark off a **10 foot** section of stream that is representative of your stream reach. Within this section, you will be measuring width, depth and calculating velocity.

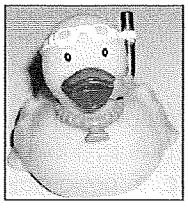
Stream Width

Take 1 measurement within the 10 foot section and record the measurement on the data sheet. Measure width from water's edge to water's edge.

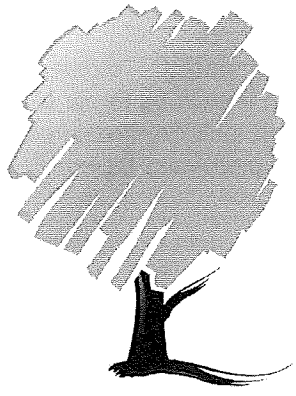
Stream Depth

Take 5 depth measurements in your 10 foot section along the width transect. You should measure at least every foot for smaller streams and every five feet for wider streams. Calculate the average of the measurements and record it on your data sheet.

Stream Velocity



With a stopwatch, measure the time it takes your rubber duck to float the 10 feet section. Repeat 5 times using the same floating tool, in the same 10-foot section and record each time on your data sheet. Then average the 5 times to determine the average time. Divide the distance (D = 10 feet) by the average time (T) to determine velocity in feet per second (V = D/T). Record this on your data sheet.



Tree Canopy Cover & Woody Debris

Tree Canopy Cover

Stand in the middle of the stream or at the stream's edge and look straight up toward the sky looking over the center of the stream. In the fall or winter try to visualize how the leaves will look in the summer on the tall overhanging treetops. Some people may find it more useful to look at the reflection of the tree canopy on the stream. Use your best

judgment in picking the option that best represents the estimated percentage of stream canopy coverage.

Woody Debris

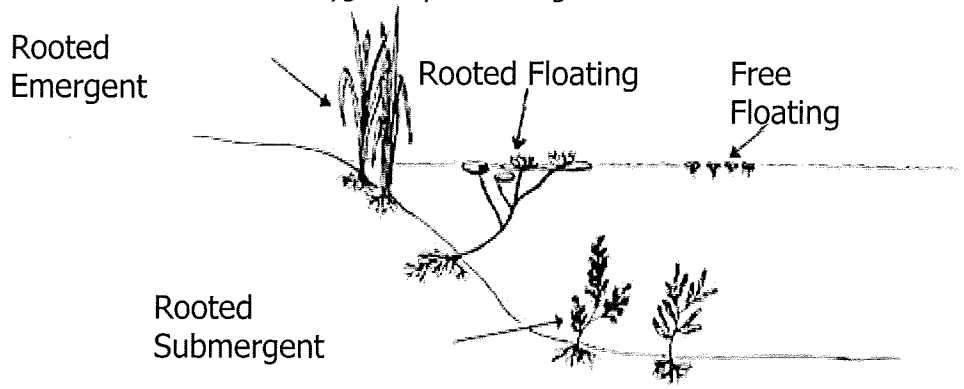
Woody debris includes logs, sticks, and branches and other wood that falls into the stream. Attached woody debris can create in-stream habitat for invertebrates and fish. Streams get a lot of their nutrients from woody debris. However, too much woody debris can negatively impact a stream by slowing down stream flow, by causing a barrier to fish movement or by nutrient overloading. Circle the option that best describes what was observed.

If the debris are free floating, it may have recently floated down stream and is not a useable habitat. However, if the debris is established and attached it will provide habitat for invertebrates and fish.

Predominant Aquatic Vegetation

Predominant Aquatic Vegetation

Aquatic vegetation is important for instream habitat. It provides food and habitat for aquatic life. However, excessive aquatic vegetation affects the health of a stream as plant respiration and decomposition uses dissolved oxygen in the water. If there are too many aquatic plants in the stream it may suffocate fish and other oxygen dependent organisms.



Source: North Central Regional Extention Publication No. 241, Carole A. Lembi, Aquatic Weed Specialist

Circle the option that best describes the predominant aquatic vegetation observed.

1. Rooted Submergent - vegetation is completely underwater
2. Rooted Emergent - vegetation is rooted in substrate and is partially exposed above the water surface
3. Rooted Floating - vegetation is rooted into the substrate and is floating on top of the water surface (an example is a lily pad)
4. Free Floating - vegetation is not rooted or attached to anything
5. None

Algae Growth & Type

Algae Growth

Algae can provide shelter and food resources for fish and macroinvertebrates; however, large populations of algae can limit the amount of oxygen available to organisms.

Algae Type

This refers to the predominate type of algae in the stream.
Filamentous refers to algae that are stringy or cotton like. Filamentous algae are single algae cells that form long visible chains, threads or filaments. These filaments intertwine forming a mat that resembles

wet wool. Often filamentous algae floats to the surface forming large mats. This type of algae often appears bulky.

Periphyton is benthic (lives on the stream bottom) algae that grow attached to surfaces such as rocks or larger plants. Periphyton are primary producers and sensitive indicators of environmental change in water bodies.

Litter & Structures

Litter Concentration

Note whether or not you see litter throughout your stream reach. Large litter should be identified in the notes section of your report. Illegal Dumping should be reported using a new mobile application, which can be accessed on smart phones at https://njwebmap.state.nj.us/DEPStopDumping

The user reports the illegal dumping location, the size and type of the dump, as well as a picture of the debris. Once the site is reported, DEP investigators will work to find the responsible party. For additional instructions on how to use the mobile application, visit: www.nj.gov/dep/stopdumping/instructions.htm

Structures

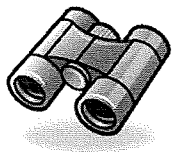
Bridges, culverts, weirs and dams are all examples of in-stream, man-made structures that will affect the stream's health. Please mark the structures observed in the stream within the reach. Also identify any other structures observed outside of your stream reach in your site stretch.

Land Use

Streamside Land Use

Go through the list of stream side land uses provided and mark everything that is present within viewing distance of the stream reach you are surveying. If you notice anything unusual or important, make sure to add it to the comments box.

Other Observations

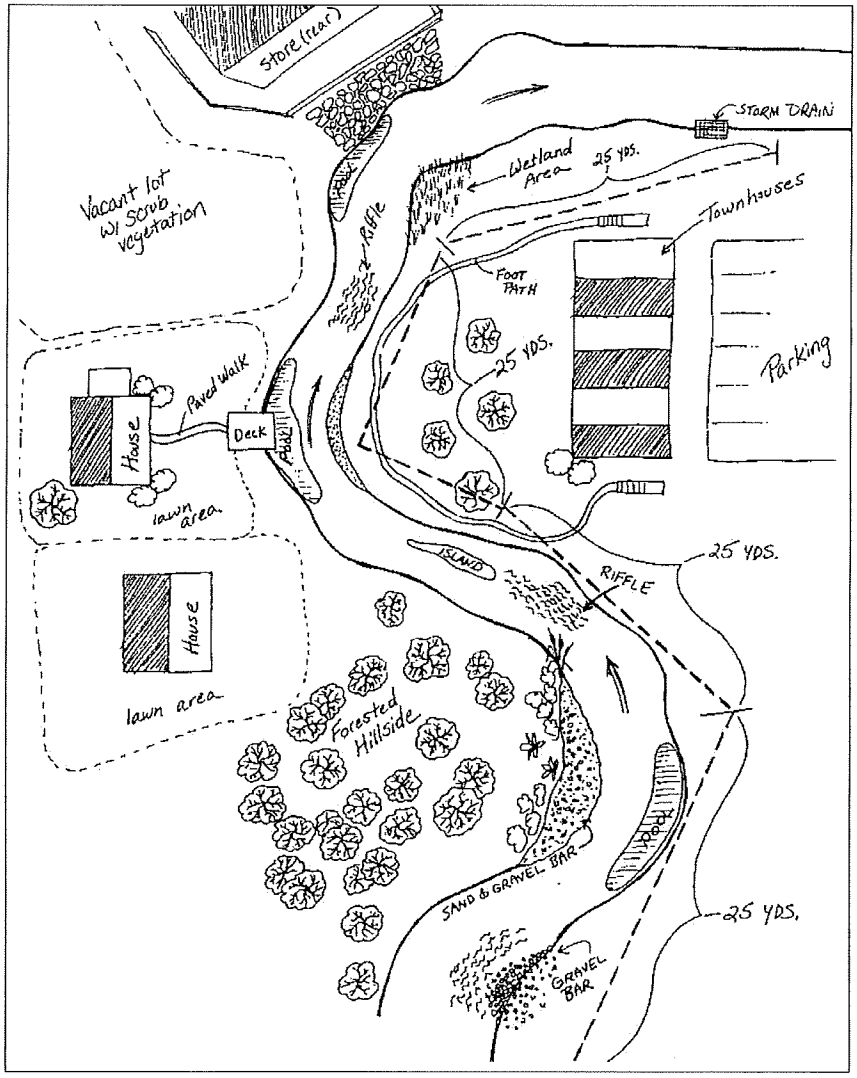


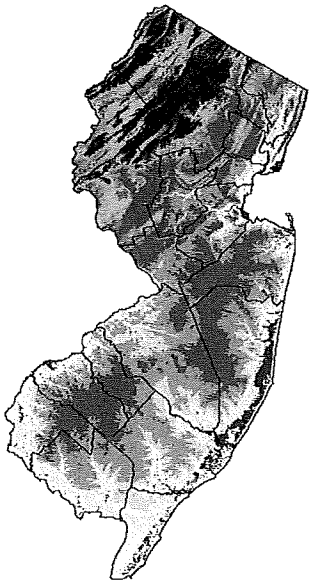
Fill in any other observations made about the reach. This can include wildlife observed, anything that appears out of the ordinary, or information obtained by talking with local residents concerning the history of land use in the area. Observation locations should be marked on the site sketch map.

Site Sketch

Site Sketch

This is a hand drawn map of your stream segment. Your map should include such features as pools, riffles, runs, road crossings, transect locations, outfalls, ditches, stream confluences, flocks of waterfowl, etc. Please be sure to include anything you may see along your stream walk. You can scan your sketch in an electronic format or take a photo of your site sketch and submit it with your assessment.





There are two predominate stream types, high gradient and low gradient. You can check GeoWeb under "Physiographic Provinces" to identify each region ie. Valley and Ridge, Highlands, Piedmont, and Coastal Plain.

High gradient indicates a steep slope and rapid flow of water with more ability to erode. High gradient streams are found in areas that have some elevation above sea level like the Valley and Ridge, Highlands or the Piedmont region.

Low gradient indicates a nearly level stream bed and sluggish moving water. Low gradient streams are found in low-lying areas like the Coastal Plains or the Pinelands.

Your monitoring sheet results will vary depending upon your stream gradient status. For example, pool and riffle variability may not be present if you are in a low gradient stream. However, in high gradient streams, pools and riffles may be easily assessable.

Score each parameter on a scale of 1-20 (or 1-10 for Left Bank and Right Bank options) and determine which range the parameter falls into such as optimal, suboptimal, marginal or poor.

After completing this entire section, add up all parameter scores to determine the health of the entire stream reach.

Epifaunal Substrate/Available Cover

* Description is different due to high and low gradient regions.

Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization in low-gradient streams. However, "new fall" will not yet be suitable for colonization.

High Gradient Stream

1. Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).
2. 40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).
3. 20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.
4. Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.

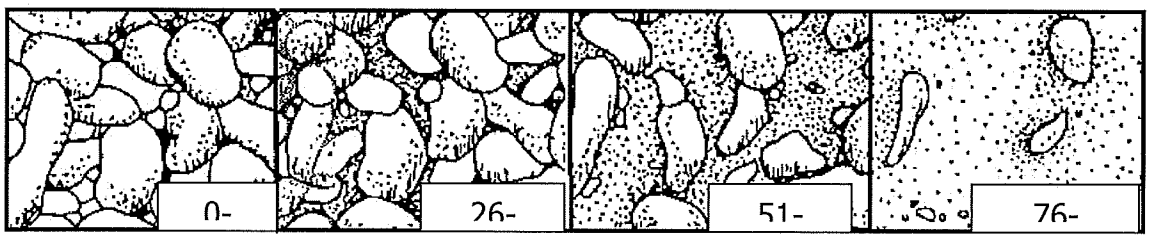
1. Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).
2. 30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).
3. 10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.
4. 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.

Pool Substrate Characterization – Low Gradient ONLY

Pool substrate characterization evaluates the types of substrates and the conditions of pools within a stream. Firmer sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in it's pools will support fewer types of organisms than a stream that has a variety of substrate types. Substrate characterization should be determined based on the range of substrates you find in each pool; hard-pan clay, bedrock, mud, silt, organic matter, etc.

Embeddedness – High Gradient ONLY

Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To estimate embeddedness, observe the amount of fine particles overlying, in between and surrounding the rocks in the bottom of the stream.



1. Gravel, cobble and boulders are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.
2. Gravel, cobble and boulders are 26-50% surrounded by fine sediment.
3. Gravel, cobble and boulders are 51-75% surrounded by fine sediment.
4. Gravel, cobble and boulders are 76% or greater surrounded by fine sediment.

Velocity/Depth Combinations– High Gradient ONLY

Stream velocity and depth can greatly affect the aquatic life of a stream. The best available habitat includes all of the following combinations of velocity and depth combinations. The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment. Record all available combinations for both wadable and non-wadable streams.

Pool Variability– Low Gradient ONLY

The overall mixture of pool types found in streams, according to size and depth. The 4 types of pools are large-shallow, large-deep, small-shallow and small-deep. A stream with many pool types will support a wide variety of aquatic species. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

1. Even mix of large-shallow, large-deep, small-shallow, small-deep pools present
2. Majority of pools large-deep; very few shallow
3. Shallow pools much more prevalent than deep pools
4. Majority of pools small-shallow or pools absent

Sediment Deposition

* Description may be different depending on if you are located within a high gradient or low gradient region.

Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.

High Gradient Streams

1. Little or no enlargement of islands or point bars and less than 5% of bottom affected by sediment deposition.
2. Some new increase in bar formation, mostly from gravel, sand or fine sediment: 5-30% of the bottom affected, slight deposition in pools.
3. Moderate deposition of new gravel, sand or fine sediment on old or new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.
4. Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition

Low Gradient Streams

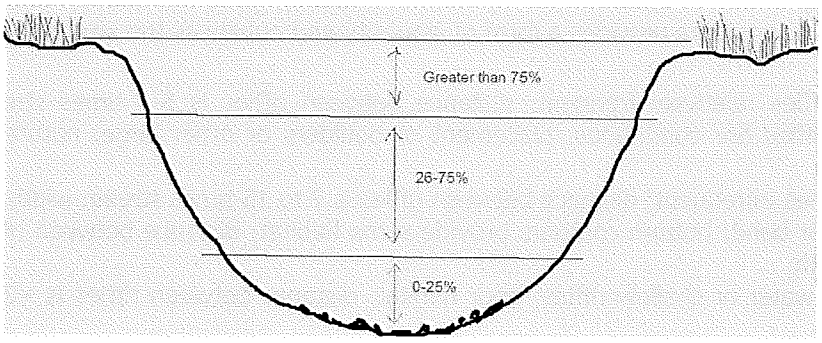
1. Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.
2. Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.
3. Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.
4. Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition

Channel Flow Status

The channel flow status is the amount of water in the channel. The flow status will change as the channel enlarges (e.g., widening caused by erosion) or as flow decreases as a result of dams and other obstructions, diversion of flow, dry weather conditions or drought.

1. **Base of both lower banks**
   Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.
2. **Greater than 75%**
   Water fills >75% of the available channel; or <25% of channel substrate is exposed.
3. **25-75%**
   Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.
4. **Very little water**
   Very little water in channel and mostly present as standing pools.

In high-gradient streams, riffle areas and cobble substrate can be exposed; in low-gradient streams, the decrease in water level exposes logs and snags and reduces the areas of good habitat for aquatic organisms. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions.



Channel Alteration

Channel alteration is any changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Signs of channelization, or straightening of the stream, may include an unnaturally straight section of a stream, high banks, lack of flow diversity (pools, riffles, runs), uniform-sized stream substrate, lack of vegetation diversity, and absence of vegetation.

1. Stream with normal pattern
2. Some channelization present, usually in areas of bridges etc.
3. Channelization extensive, 40-80% of the streams reach
4. Over 80% of the stream channelized, gabion baskets and/or riprap, and/or concrete present

Channel Sinuosity – Low Gradient ONLY

Sinuosity refers to the natural tendency for a stream to meander. A high degree of sinuosity provides for diverse habitat and fauna, and can better handle increased flow when the stream level fluctuates as a result of storms. Meandering allows for the absorption of the energy of moving water and protects the stream from excessive erosion and flooding and provides refuge for benthic invertebrates and fish during storm events. For purposes of measuring sinuosity, volunteers may want to consider a longer segment or reach when evaluating this parameter.

1. Sharp bends (oxbows): The bends increase the stream length by 3-4 times compared to if it was in a straight line.
2. Moderate bends: The bends in the stream increase the stream length by 2-3 times compared to if it was in a straight line
3. Slight bends: The bends in the stream increase the stream length by 1-2 times compared to if it was in a straight line.
4. Straight-channelized: the channel is straight and has obviously been channelized with an artificial lining or bank stabilization.

Frequency of Riffles–High Gradient ONLY

Riffles are shallower depth areas of the stream segment with faster, turbulent water running over gravel and/or rocks. The frequency of riffles refers to the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna, therefore, an increased frequency of occurrence enhances the diversity of the stream community. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream.

1. Occurrence of riffles relatively frequent; distance between riffles is 5-7 times stream width. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.
2. Occurrence of riffles infrequent; distance between riffles is 7 to 15 times stream width.
3. Occasional riffle or bend; bottom contours provide some habitat; distance between riffles is 15 to 25 times stream width.
4. Generally all flat water or shallow riffles; poor habitat; distance between riffles is >25 times stream width

Bank Stability

*Note: Be sure to score both Left and Right Banks - left and right bank are determined by looking up stream.

Bank Stability refers to the existence of or the potential for detachment of soil from the stream banks and its movement into a stream. Excessive bank erosion occurs when the watershed surrounding the stream has been altered. Signs of erosion may include exposed tree roots, undercut banks, unvegetated banks and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams.

1. Stable: Evidence of erosion or bank failure absent or minimal; <5% of bank affected.
2. Moderately Stable: Small areas of erosion, mostly healed over; 5-30% of bank in reach has areas of erosion.
3. Moderately Unstable: 31-60% of bank in reach has areas of erosion, high erosion potential during flooding.
4. Unstable: Many eroded areas, bald areas frequent; obvious bank sloughing; 60% or more of bank shows erosion scars.

Bank Vegetative Protection

* Note: Be sure to score both Left and Right Banks- left and right bank are determined by looking up stream.

Bank Vegetative Protection is the vegetation protecting the stream's banks and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold the soil in place, thereby reducing the amount of erosion that is likely to occur. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection.

Looking upstream evaluate how much of the stream bank is covered by vegetation.

1. Greater than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.
2. 70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.
3. 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.
4. Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.

Riparian Vegetation

This is quantifies the width of the riparian zone. It is the measure of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports in stream habitat; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Natural vegetation should consist of a good mix of plants including grasses, forbs, shrubs, understory trees and large trees. Again, left and right bank is determined by looking up stream.

1. Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.
2. Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.
3. Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.
4. Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

Habitat Score

In order to fully understand the health of the stream reach add up all of the scores of each habitat parameter. After totaling you will receive one of the following scores.

Optimal: 160-200
Sub-Optimal: 110-159
Marginal: 60-109
Poor: <60

Pipe Information

Latitude and Longitude
Take a GPS point where the pipe discharges into the stream

NJPDES #- if applicable
If the pipe has a permit number posted on it or near it, record that number in the space provided.

Pipe Diameter
Enter the estimated diameter or measure the diameter of the pipe.

Type
Circle the best description for the type of discharge from the pipe.

1. Storm Drain Discharge is from storm sewers in adjacent developments or highway/road systems.

2. Residential Discharge is a pipe from a nearby home discharging water from a sump, drain or washer.

3. Industrial Discharge (NJPDES#) means a permitted industrial discharge. These discharges will be clearly marked in the field and should be identified prior to going out. The NJPDES permit number should be recorded here.

4. Combined Sewer Overflows are sewer systems that carries both sewage and stormwater runoff during rain events. Normally, its entire flow goes to a waste water treatment plant, but during a heavy storm, the volume of water may be so great as to cause overflows of untreated mixtures of stormwater and sewage into receiving waters.

5. Other is any other discharge that you observe whether or not you can identify the specific type.

Pipe Material
In most cases you will find a pipe made from one of the following materials

Pipe Location
Circle the option that best describes the location of the pipe in relation to the stream bank.

1. In Water-the end of the discharge pipe is located at the bottom of the stream bank or in the channel.

2. In Bank-the discharge pipe is coming out of the stream bank

3. Near Water -discharge pipe is located at or slightly behind the top bank and discharges down the bank.

Pipe Flow/Appearance
Circle the option that best describes the flow coming out of the pipe.

Is the stream bank at the outfall eroded?
1. Yes 2. No

Is stream bed eroded downstream?
1. Yes 2. No

Habitat Assessment- High Gradient
New Jersey Department of Environmental Protection

General Sheet

*** Site ID:** _____ *** Watershed Management Area:** _____

*** Site Name:** _____ *** County:** _____

*** Segment Identification:** Latitude/Longitude: _____

Estimate of Segment Length (aim for 100m): _____

*** Survey Team:** _____

*** Time:** _____ *** Date:** _____

*** Today's Weather:** Clear Partly Cloudy Overcast Light Rain
(Circle one) Steady Rain Heavy Rain Snow Heavy Snow Melt

Days since last rain: _____

Air Temperature: _____ ° C

Water Temperature: _____ ° C

Water Conditions: Circle the term that best fits each category

Odor:	Normal Sewage Petroleum Chemical Anaerobic (rotten eggs) Other
Turbidity:	Clear Slightly turbid Turbid
Surface Coating:	None Oily Foam Scum Other
Stream Flow:	Slow Moderate Swift Combination

Stream Measurements: Measure width, depth and calculate velocity

Transect Measurements (10 feet):	
Width	_____, _____, _____, _____, _____ = Average _____ meters
Depth	_____, _____, _____, _____, _____ = Average _____ meters
Velocity	_____, _____, _____, _____, _____ = Average time _____ seconds
	Distance/Average time = _____ meters/second

Stream Characteristics: Circle the term that best fits each category

Canopy:	Open (0-25%) Mostly Open (26 – 50%) Partly Open (51-75%) Mostly Closed/Closed (76-100%)
Woody Debris:	Abundant Moderate Scarce None
Predominant Aquatic Vegetation (choose most abundant type):	Rooted emergent Rooted submergent Rooted floating Free floating No vegetation
Algae Growth:	Abundant Moderate Scarce None
Algae Location (choose most abundant type):	Filamentous Periphyton None
Litter Concentration:	Present Absent If present, how much: _____%
Structures:	None Bridges Culverts Dams Other_____

Assessment Sheet

Land Use Characteristics: Mark off the features present within viewing distance of your stream reach

- ☐ Agricultural Feed Lots
- ☐ Athletic Fields
- ☐ Camping
- ☐ Cemetery
- ☐ Commercial
- ☐ Construction
- ☐ Cropland
- ☐ Dumping
- ☐ Golfing, Resorts
- ☐ Hiking / Paths
- ☐ Horse Trails
- ☐ Inactive Fields
- ☐ Industrial Plants
- ☐ Livestock Use
- ☐ Maintained Lawns
- ☐ Marinas
- ☐ Mines/Quarries
- ☐ Orchards
- ☐ Other: _____
- ☐ Parking Lots
- ☐ Pasture
- ☐ Preserved Open Space
- ☐ Recycling/ Waste Facility
- ☐ Residences
- ☐ Residential Pets / Pet Waste
- ☐ Roads Paved
- ☐ Roads Unpaved
- ☐ Sewage Treatment
- ☐ Stormwater Basin
- ☐ Swimming / Fishing / Canoeing / Boating
- ☐ Waterfowl (approx. #) _____
- ☐ Wetlands

General Observations (60 Characters):

_____

_____

Comments:_____

_____

_____

Site Sketch: Include stream flow, roads, sampling locations, and entry point for the stream assessment

High Gradient Monitoring Sheet

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Combinations	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3 m/s, deep is >0.5 m/s)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity / depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total Habitat Score (1-5)

	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles is 5-7 times stream width; variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles is 7 to 15 times stream width.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles is 15 to 25 times stream width.	Generally all flat water or shallow riffles; poor habitat; distance between riffles is >25 times stream width.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing upstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Bank Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

HABITAT SCORE (1-5) + **HABITAT SCORE (6-10)** = **TOTAL HABITAT SCORE :**

Rating:

HABITAT SCORES	VALUE
OPTIMAL	160 – 200
SUB-OPTIMAL	110 – 159
MARGINAL	60 – 109
POOR	< 60

Pipe & Drainage Ditch Sheet

Fill in the blanks and circle the best options for each pipe in your stream reach (add more pages as necessary)

Lat and Long	NJPDES # (if applicable)	Pipe Diameter (in or ft)	Type	Pipe Material	Pipe Location	Pipe Flow	Is stream bank at outfall eroded?	Is stream bed eroded downstream?
			Storm Drain Industrial Drain Residential Discharge Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Industrial Drain Residential Discharge Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Industrial Drain Residential Discharge Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Industrial Drain Residential Discharge Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No

Habitat Assessment- Low Gradient

New Jersey Department of Environmental Protection

General Sheet

*** Site ID:** _____ *** Watershed Management Area:** _____

*** Site Name:** _____ *** County:** _____

*** Segment Identification:** Latitude/Longitude: _____

Estimate of Segment Length (aim for 100m): _____

*** Survey Team:** _____

*** Time:** _____ *** Date:** _____

*** Today's Weather:** Clear Partly Cloudy Overcast Light Rain
(Circle one) Steady Rain Heavy Rain Snow Heavy Snow Melt

Days since last rain: _____

Air Temperature: _____ ° C

Water Temperature: _____ ° C

Water Conditions: Circle the term that best fits each category

Odor:	Normal Sewage Petroleum Chemical Anaerobic (rotten eggs) Other
Turbidity:	Clear Slightly turbid Turbid
Surface Coating:	None Oily Foam Scum Other
Stream Flow:	Slow Moderate Swift Combination

Stream Measurements: Measure width, depth and calculate velocity

Transect Measurements (10 feet):	
Width	_____, _____, _____, _____, _____ = Average _____ meters
Depth	_____, _____, _____, _____, _____ = Average _____ meters
Velocity	_____, _____, _____, _____, _____ = Average time _____ seconds
	Distance/Average time = _____ meters/second

Stream Characteristics: Circle the term that best fits each category

Canopy:	Open (0-25%) Mostly Open (26 – 50%) Partly Open (51-75%) Mostly Closed/Closed (75 – 100%)
Woody Debris:	Abundant Moderate Scarce None
Predominant Aquatic Vegetation: (choose most abundant type)	Rooted emergent Rooted submergent Rooted floating Free floating No vegetation
Algae Growth:	Abundant Moderate Scarce None
Algae Location: (choose most abundant type)	Filamentous Periphyton None
Litter Concentration:	Present Absent If present, how much _____ %
Structures:	None Bridges Culverts Dams Other: _____

Assessment Sheet

Land Use Characteristics: Mark off the features present within viewing distance of your stream reach

☐ Agricultural Feed Lots	☐ Mines/Quarries
☐ Athletic Fields	☐ Orchards
☐ Camping	☐ Other: _____
☐ Cemetery	☐ Parking Lots
☐ Commercial	☐ Pasture
☐ Construction	☐ Preserved Open Space
☐ Cropland	☐ Recycling/ Waste Facility
☐ Dumping	☐ Residences
☐ Golfing, Resorts	☐ Residential Pets / Pet Waste
☐ Hiking / Paths	☐ Roads Paved
☐ Horse Trails	☐ Roads Unpaved
☐ Inactive Fields	☐ Sewage Treatment
☐ Industrial Plants	☐ Stormwater Basin
☐ Livestock Use	☐ Swimming / Fishing / Canoeing / Boating
☐ Maintained Lawns	☐ Waterfowl (approx. #) _____
☐ Marinas	☐ Wetlands

General Observations (60 Characters):

_____

_____

Comments: _____

_____

_____

Site Sketch: Include stream flow, roads, sampling locations, and entry point for the stream assessment

Low Gradient Monitoring Sheet

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. (Deep > 1m; large is width or length > half cross-section of stream)	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total Habitat Score (1-5)

6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length by 3 to 4 times compared to if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).	The bends in the stream increase the stream length by 2 to 3 times compared to if it was in a straight line.	The bends in the stream increase the stream length by 1 to 2 times compared to if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Bank Vegetative Protection (score each bank) Note: determine left or right side by facing upstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

HABITAT SCORE (1-5)	+	**HABITAT SCORE (6-10)**	=	**TOTAL HABITAT SCORE:** **Rating:**

HABITAT SCORES	VALUE
OPTIMAL	160 – 200
SUB-OPTIMAL	110 – 159
MARGINAL	60 – 109
POOR	< 60

Pipe & Drainage Ditch Sheet

Fill in the blanks and circle the best options for each pipe in your stream reach (add more pages as necessary)

Lat and Long	NJPDES # (if applicable	Pipe Diameter (in or ft)	Type	Pipe Material	Pipe Location	Pipe Flow:	Is stream bank at outfall eroded?	Is stream bed eroded downstream?
			Storm Drain Residential Discharge Industrial Drain Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Residential Discharge Industrial Drain Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Residential Discharge Industrial Drain Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No
			Storm Drain Residential Discharge Industrial Drain Combined Sewer Overflow Other	Concrete Steel Plastic Clay Other	In Water In Bank Near Water	None Trickle Intermittent Steady Heavy	Yes No	Yes No

Glossary

Algae: A chlorophyll-containing plant ranging from one to many cells in size that lives in fresh or salt water.

Baseflow: The portion of stream flow that is derived from groundwater; average stream discharge during low flow conditions.

Benthic (Bottom-dwelling)**:** The plant and animal life whose habitat is the bottom of a sea, lake, or river.

Channelization: Straightening of a stream channel to make water move faster.

Channelized: The straightening and deepening of streams. Channelization reduces the ability of the stream to assimilate waste and disturbs fish breeding areas.

CPOM: Coarse Particulate Organic Matter. Material of plant or animal origin that is suspended in water.

Culvert: A channel used for draining water, often enclosed in steel, concrete, or plastic; can be used to allow water to pass underneath a road or embankment.

Ecosystem: The interacting system of a biological community (plants, animals) and its non-living environment.

Effluent: The wastewater from a municipal or industrial source that is discharged into the water.

Embeddedness: The degree to which objects in the stream bottom are surrounded by sediment.

Erosion: The wearing away of the land surface by wind or water.

Eutrophication: A process where water bodies receive excess nutrients that stimulate excessive plant growth.

Floodplain: The flat area of land adjacent to a stream that is formed by flood processes.

Geospatial: Of or relating to the relative position of things on the earth's surface

Gradient: The slope or steepness of the stream.

Habitat: The natural environment in which a species or group of species lives.

Macrophytes: Aquatic plants, growing in or near water that are either emergent, submergent, or floating.

Macroinvertebrate: Organisms found attached to rocks or within the sediments of the stream bed, often larval stages of insects and are indicative of stream health.

Non-Point Source Pollution: "Diffuse" pollution, generated from large areas with no particular point of pollutant origin, but rather from many individual places. Urban and agricultural areas generate nonpoint source pollutants.

Nutrient: Any substance, such as fertilizer, phosphorus, and nitrogen compounds, which enhances the growth of plants and animals.

Outfall: The outlet or place of discharge of a river, drain, sewer, etc.

Point Source Pollution: A discharge of water pollution to a stream or other body of water, via an identifiable pipe, vent, or culvert.

Pool: An area of relatively deep slow water in a stream that offers shelter to fish.

Quality Assurance (QA): Quality Assurance is the larger system to see that Quality Control (QC) is maintained. QA asks if we are doing the right things (in our case are we monitoring the right things to detect changes in water quality).

Reach: A stream section with fairly similar characteristics.

Riffle: A shallow, gravely area of streambed with swift current where water is breaking over rocks, wood, or other partly submerged debris and producing surface agitation.

Riprap: A sustaining wall built of rocks.

Riparian Zone: An area, adjacent to and along a watercourse, which is often vegetated and constitutes a buffer zone between the nearby lands and the body of water.

Run: A stretch of fast smooth current, deeper than a riffle.

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually returns to streams. Runoff can pick up pollutants from the air or the land and carry them to streams, lakes, and oceans.

Sediment: Fine soil or mineral particles that settle to the bottom of the water or are suspended in the water.

Stormwater Runoff: Water that washed off the land after a rainstorm. In developed watersheds it flows off of roofs and pavement into storm drains which may feed directly into the stream; often carries concentrated pollutants.

Substrate: The material that makes up the bottom layer of the stream, such as gravel, sand, or bedrock.

Suspended Sediments: Fine material or soil particles that remain suspended by the current until deposited in areas of weaker current. They create turbidity and when deposited, can smother fish eggs or early plant growth.

Topographic: The configuration of a surface area including its relief, or relative elevations, and the position of its natural and man-made features.

Turbidity: Cloudiness of the water, caused by suspended sediments or excess organic matter.

Vegetation: All the plants or plant life of a place, taken as a whole

APPENDIX II

NJDEP Volunteer Monitoring
Thermometer Calibration SOP

Thermometers should be calibrated once a year.

Materials:

- Thermometers to be calibrated
- NIST thermometer with updated certificate
- Wide container to hold water at least eight inches deep
- Calibration Log:
- Ice
    - V:\lum\WM&S\WQSA Files\Volunteer Monitoring\Volunteer Monitoring\QAPP\Temperature QAPP\Calibration Event Log

Set-up

- Fill the container with room temperature water. The water must be within the range of 21°C and 29°C
- Place the NIST thermometer and all the thermometers to be calibrated in the water.
- Allow five minutes or so to pass so that the thermometers can stabilize
- Fill in the top section of the Calibration Event Log. Record the information about the thermometer's owner, the serial number for the NIST and the date it expires, also record the name(s) of the people performing the calibration

Lab

* It is helpful to have two people for the lab portion of the calibration, one to call out the readings from the thermometers and the other to record. Because your hands will get wet it is sometimes frustrating to read and record on your own.

25°C

- Select one of the thermometers to be calibrated and record the thermomter's unique ID on the Calibration Event Log.
- Read the temperature on the NIST thermometer and record in the 25°C row of the first table of the Calibration Event Log under the column "NIST Reading"
- Record the NIST correction listed on the NIST certificate under "NIST Correction"
- Read the temperature on the thermometer being calibrated and record in the 25°C row under "Field Reading"
- Repeat each step filling in a new table on the Calibration Event Log for each of the thermometers to be calibrated

0°C

- Place the NIST thermometer in a safe location and pour about 1/4 of the water out of the container you are using to calibrate and add ice to return the water level to the original volume
- Give the ice a few minutes to drop the water temperature and then check the temperature using the NIST thermometer. The temperature must drop below **8°C** before you can begin the next step. Add more ice if necessary.

- Repeat each step from the 25°C section, but this time fill in the 0°C row of each table, making sure to match the thermometer ID to the table you are recording in.

Calculations

- Open the following Excel file:
  - V:\lum\WM&S\WQSA Files\Volunteer Monitoring\Volunteer Monitoring\QAPP\Temperature QAPP/ Calculation Program
- Fill out the Excel sheet by following the highlighted examples
- You will only have to enter the NIST Corrections once and they will be copied throughout the rest of the table.
-

Certificate

- Copy the table you created in Excel into the Certificate file located here (paste your new table over the table given as an example):
  - V:\lum\WM&S\WQSA Files\Volunteer Monitoring\Volunteer Monitoring\QAPP\Temperature QAPP\Certificate Ex
- Fill in the date of calibration, date of expiration, and the name of the organization the thermometers were tested for
- It is easier to read the table within the certificate if you turn the gridline on.
- Place a * next to any thermometer ID that has a correction of more than one degree. The * shows that we recommend the thermometer be replaced.
- Print the certificate off and sign the bottom
- Make a copy for our records and give the original to the organization that owns the thermometers.